REMARKS

Reconsideration of the Application is requested. Applicant will show that the cited combination of references would not have been obvious to one of ordinary skill in the art at the time of invention. Additionally, Applicant will show that the combination of references are not enabling and would require undue experimentation to reduce to practice. Finally, as alternative, Applicant directs the Examiner to the secondary considerations previously provided, thereby showing that the combination of references was not obvious to one of ordinary skill in the art at the time of reduction to practice. Included in the secondary considerations is evidence proving that Applicant's competitors copied his invention.

In preparation and transmitting the previous 02/25/04 Amendment, which was in response to the first Office Action of Examiner Barry, Applicant inadvertently did not include an IDS along with three industry references, specifically: a 1996 paper authored by Chitikela and Dentel, a 1990 paper authored by Prakasam of the US EPA and a 2000 WEFTEC paper authored by Virginia Polytechnic Institute. This filing error was noticed when an incorrect Office Action by a US PTO employee dated 03/29/04 was sent to Applicant requiring that the modified claims be presented according to 37 CFR 1.121 instead of the proper 37 CFR 1.73(b)(2) or 37 CFR 1.530 (d)(2), as is appropriate in a re-issue proceeding. To properly correct, Applicant contacted the Examiner on 04/20/04 requesting of the Examiner ability to correct claim construction according to 37 CFR 1.73(b)(2). During that conversation the 02/25/04 IDS omission was noticed. At that time, it was also noticed by the Examiner that entry of the 02/25/04 Amendment had been performed wherein another US PTO employee had incorrectly indicated a specification change by Applicant. With data entry challenges creating confusion for this proceeding, the Examiner instructed Applicant not to make any more filings (including the IDS) and that the Examiner would act on the 02/25/04 Amendment on its merits. Given the events and importance of the industry references, Applicant respectfully requests the US PTO include in this response after final the attached IDS along the three previously discussed industry references, which were attached to the 02/25/04 Amendment, after which it was required of Applicant not to file an IDS given entry challenges which were occurring at that time.

A sincere note of appreciation is afforded to the Examiner for his time in managing the aforesaid housekeeping challenges.

Marked-up Set of Claims (According to 37 CFR 1.73(b)(2) and Examiner Review)

1. (Four times amended) A method for dewatering thermophilic biological sludge[that has been digested by a thermophilic digestion process], comprising:

a. adding [polymeric quaternary ammonium compounds, aluminum sulfate, ferric chloride and blends thereof as]a primary component[,] to the thermophilic biological sludge;

said primary component comprising at least one of aluminum sulfate and ferric chloride; wherein

said primary component may also comprise a polyquaternary ammonium compound; and

b. adding a cationic or anionic polyacrylamide to the thermophilic biological sludge[; such that any combinations of the primary component and of the polyacrylamides enhance dewatering of the sludge].

2. (Four times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound[s are from] is of the di-allyl di-methyl ammonium chloride (DADMAC) family of compounds.

3. (Four times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound[s are from] is of the epichlorohydrin di-methyl amine (epi-DMA) family of compounds.

4. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein [the polymeric quaternary ammonium compound, aluminum sulfate, ferric chloride and blends thereof are]said primary component is added directly to [the]said thermophilic biological sludge and, upon formation of microflocs of the sludge from [the polymeric quaternary ammonium compound, aluminum sulfate, ferric chloride and blends thereof]said primary component, said cationic polyacrylamide is added[to form a floc that dewaters the sludge].

5. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the ratio[s] of the polymeric quaternary ammonium compound[s] with respect to aluminum sulfate range from about 1:16 to about 1:2, by weight.

6. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the ratio[s] of the polymeric quaternary ammonium compound[s] with respect to ferric chloride range from about 1:8 to about 1:10, by weight.

7. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the ratio[s] of the polyacrylamide with respect to aluminum sulfate range from about 1:80 to about 1:8, by weight.

8. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the ratio[s] of the polyacrylamide with respect to ferric chloride range from about 1:70 to about 1:7, by weight.

9. (Twice amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of [the]said themophilic biological sludge is between about 50 ppm:1 percent and about 350 ppm:1 percent.

10. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein [the polymeric quaternary ammonium compound, aluminum sulfate, ferric chloride and blends thereof, are]said primary component is added directly to [the]said thermophilic biological sludge in an amount sufficient to cause formation of a cationic overcharge within a developed micro floc system, [and an]then said anionic polyacrylamide is added[for final floc formation].

11. (Four times amended) The method for dewatering thermophilic biological sludge according to claim 10, wherein [the polymeric quaternary ammonium compound]said primary component and [the]said anionic polyacrylamide are in an approximate[ly] 1:8 to 20:1 ratio by weight[with the anionic polyacrylamide having a higher molecular weight than the polymeric quaternary ammonium compound does].

12. (Twice amended) The method for dewatering thermophilic biological sludge according to claim 10, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of [the]said thermophilic biological sludge is between approximately 50 ppm:1 percent and approximately 5000 ppm:1 percent.

13. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein [the]said thermophilic biological sludge is mixed with primary sludge.

14. **Claim 14 has been deleted.**

15. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein [the polymeric quaternary ammonium compounds, aluminum sulfate, ferric chloride and blends thereof, as well as the]said primary component and said polyacrylamide is used in solution, in emulsion or in dry form.

16. (Previously added) A sludge composition, comprising:
water;
solids comprising thermophiles;
aluminum sulfate; and
polyacrylamide.

17. (Previously added) A sludge composition, comprising:
water;

solids comprising thermophiles;
ferric chloride; and
polyacrylamide.

18. (Previously added) A sludge composition, comprising:
water;
solids comprising thermophiles;
aluminum sulfate and ferric chloride; and
polyacrylamide.

19. (Previously added and currently amended) The sludge of claim 16, 17 or 18, including a polyquaternary ammonium compound.

20. (Previously added and currently amended) The sludge of claim 19, wherein the polyquaternary ammonium compound is of the DADMAC family of compounds and/or of the epi-DMA family of compounds.

21. (Previously added and currently amended) The sludge of claim 16, 17 or 18, wherein said polyacrylamide is cationic or anionic.

Please cancel claims 22 through 38.

39. (New) The sludge of claim 16, 17 or 18, further comprising primary sludge.

Clean Set of Claims (According to 37 CFR 1.73(b)(2) or 37 CFR 1.530(d)(2))

1. (Four times amended) A method for dewatering thermophilic biological sludge, comprising:

   a. adding a primary component to the thermophilic biological sludge;

      said primary component comprising at least one of aluminum sulfate and ferric chloride; wherein

      said primary component may also comprise a polyquaternary ammonium compound; and

   b. adding a cationic or anionic polyacrylamide to the thermophilic biological sludge.

2. (Four times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is of the di-allyl di-methyl ammonium chloride (DADMAC) family of compounds.

3. (Four times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the polymeric quaternary ammonium compound is of the epichlorohydrin di-methyl amine (epi-DMA) family of compounds.

4. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein said primary component is added directly to said thermophilic biological sludge and, upon formation of microflocs of the sludge from said primary component, said cationic polyacrylamide is added.

5. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the ratio of the polymeric quaternary ammonium compound with respect to aluminum sulfate range from about 1:16 to about 1:2, by weight.

6. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the ratio of the polymeric quaternary ammonium compound with respect to ferric chloride range from about 1:8 to about 1:10, by weight.

7. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the ratio of the polyacrylamide with respect to aluminum sulfate range from about 1:80 to about 1:8, by weight.

8. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the ratio of the polyacrylamide with respect to ferric chloride range from about 1:70 to about 1:7, by weight.

9. (Twice amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of said themophilic biological sludge is between about 50 ppm:1 percent and about 350 ppm:1 percent.

10. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein said primary component is added directly to said thermophilic biological sludge in an amount sufficient to cause formation of a cationic overcharge within a developed micro floc system, then said anionic polyacrylamide is added.

11. (Four times amended) The method for dewatering thermophilic biological sludge according to claim 10, wherein said primary component and said anionic polyacrylamide are in an approximate 1:8 to 20:1 ratio by weight.

12. (Twice amended) The method for dewatering thermophilic biological sludge according to claim 10, wherein the polymer concentration to solids ratio of total polymer dosage requirement in relationship to percentage of solids component of said

thermophilic biological sludge is between approximately 50 ppm:1 percent and approximately 5000 ppm:1 percent.

13. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein said thermophilic biological sludge is mixed with primary sludge.

14. **Claim 14 has been deleted.**

15. (Three times amended) The method for dewatering thermophilic biological sludge according to claim 1, wherein said primary component and said polyacrylamide is used in solution, in emulsion or in dry form.

16. (Previously added) A sludge composition, comprising:
water;
solids comprising thermophiles;
aluminum sulfate; and
polyacrylamide.

17. (Previously added) A sludge composition, comprising:
water;
solids comprising thermophiles;
ferric chloride; and
polyacrylamide.

18. (Previously added) A sludge composition, comprising:
water;
solids comprising thermophiles;
aluminum sulfate and ferric chloride; and
polyacrylamide.

19. (Previously added and currently amended) The sludge of claim 16, 17 or 18, including a polyquaternary ammonium compound.

20. (Previously added and currently amended) The sludge of claim 19, wherein the polyquaternary ammonium compound is of the DADMAC family of compounds and/or of the epi-DMA family of compounds.

21. (Previously added and currently amended) The sludge of claim 16, 17 or 18, wherein said polyacrylamide is cationic or anionic.

Please cancel claims 22 through 38.

39. (New) The sludge of claim 16, 17 or 18, further comprising primary sludge.

Claim List – Status and Support of Current Amendment Changes

Claim	Status	Type	Support for Current Changes
1	Four Times Amended	Method	Claim format has been changed so as to comply with 37 CFR 1.75. There are no substantive changes.
2	Four Times Amended	Method	"family' has been changed to "family of compounds" so as to make this claim grammatically correct. Support for this wording can be found in col. 5 lines 45 – 53 and col. 6 lines 31 – 37 and col. 6 lines 55 - 60 and col. 8 lines 31 – 47 and col. 9 lines 6 – 11. Webster's dictionary definition for family and for compound.
3	Four Times Amended	Method	"family' has been changed to "family of compounds" so as to make this claim grammatically correct. Support for this wording can be found in col. 5 lines 45 – 53 and col. 6 lines 31 – 37 and col. 6 lines 55 - 60 and col. 8 lines 31 – 47 and col. 9 lines 6 – 11. Webster's dictionary definition for family and for compound.
4	Three Times Amended	Method	No changes in this amendment.
5	Three Times Amended	Method	Claim has been changed to recite col. 8 line 49.
6	Three Times Amended	Method	Claim has been changed to recite col. 8 line 49.
7	Three Times Amended	Method	No changes this amendment.
8	Three Times Amended	Method	Claim has been changed to recite col. 8 line 59.
9	Two Times Amended	Method	No changes in this amendment.
10	Three Times Amended	Method	No changes in this amendment.
11	Four Times Amended	Method	Grammatical correction – approximately to approximate. There are no substantive changes.
12	Two Times Amended	Method	No changes in this amendment.
13	Three Times Amended	Method	No changes in this amendment.
14	Deleted	N/A	N/A

15	Three Times Amended	Method	No changes in this amendment.
16	Previously Added	Composition	No changes in this amendment.
17	Previously Added	Composition	No changes in this amendment.
18	Previously Added	Composition	No changes in this amendment.
19	Previously Added Currently Amended	Composition	Grammatical corrections: claims to claim and removal of colon.
20	Previously Added Currently Amended	Composition	"family' has been changed to "family of compounds" so as to make this claim grammatically correct. Support for this wording can be found in col. 5 lines 45 – 53 and col. 6 lines 31 – 37 and col. 6 lines 55 - 60 and col. 8 lines 31 – 47 and col. 9 lines 6 – 11. Webster's dictionary definition for family and for compound.
21	Previously Added Currently Amended	Composition	Grammatical correction claims to claim.
22-38	Cancelled	N/A	N/A
39	New	Composition	Col. 4 line 55 – col. 5 line 2.

<u>**Examiner's Response to Arguments**</u>

At page 10, Applicant recounts a chain of events which applicant believes supports the view that "the Nielsen patent should not be valid" and "may not have been filed according to the rules of the USPTO." Every patent is assumed valid. See 35 U.S.C. Sec. 282. See also MPEP Sec. 1701 regarding Examiner's commenting on the validity of issued patents. If Applicant is aware of evidence raising a substantial new question of patentability regarding any unexpired patent, Applicant is urged to consider filing a request for reexamination of that patent. As for proper rule-abiding riling of the Nielsen patent, the Nielsen patent is not at issue in this proceeding.

At page 15, Applicant admits that Nielsen "does present the dewatering of digested thermophilic bacteria."

At page 16, Applicant attacks the enablement of the Nielsen reference. The Examiner has carefully studied the supporting affidavit filed by Applicant. Insofar as Applicant did not address each <u>Ex parte Forman</u> factor, in the affidavit or the Remarks, this argument will not be considered further. It remains Applicant's burden, should he pursue this line of reasoning, to clearly demonstrate lack of enablement of a US patent which, as noted above, is presumed to be valid under 35 U.S.C. 282.

Applicant argues at page 16 that Nielsen does not describe the use of a metal salt. The Examiner agrees that Nielsen does not teach use of a metal salt. Applicant should be reminded, however, that the Examiner never so contended. Rather, the Examiner's position has been (at page 6 of the 9/2003 action) and remains that it would have been obvious to have substituted an inorganic coagulant for Nielsen's Percol 406.

Applicant argues at page 16 that neither Nielsen nor Sorensen appreciates the importance of a quaternized or a "highly charged" coagulant or a polyquaternary amine used in combination with a cationic or anionic polyacrylamide. This argument is not germane to the allowability of claim 1 because claim 1 does not <u>require</u>, i.e., is not limited by, addition of a primary component comprising a polyquaternary compound in combination with a "highly charged" polyacrylamide. Importantly, claim 1 optionally includes addition of a polyquaternary ammonium compound: Claim 1 does not require addition of a quaternary material of any kind. The cationic or anionic polyacrylamide is not limited to a "highly charged" polyacrylamide.

See also page 18 for applicant's similar arguments regarding the Pohoreski patent. The Examiner in turn responds similarly.

Applicant is invited to produce evidence to support the assertion that "Both [municipalities and industry] would prefer to dump the sewage into the closest stream and let the down stream inhabitants worry about the disposal problem [than take corrective action]" (at page 20).

Applicant's General Discussion in Relation to 35 USC § 103 Rejections

Applicant respects the Examiner's § 103 rejections.

For the purpose of this discussion, Applicant will use claim 1 as a guide. Claim 1 as well as all of the independent claims, require at least thermophiles or a biological sludge that has been digested by a thermophilic digestion process and the contacting of the thermophilic sludge or thermophiles with a salt of aluminum and/or of iron in combination with a cationic or anionic polyacrylamide; the claims state the use of aluminum sulfate and/or ferric chloride and the use of a cationic or anionic polyacrylamide. As an example claim 1 claims:

"1. A method for dewatering thermophilic biological sludge, comprising:

a. adding a primary component to the thermophilic biological sludge;

said primary component comprising at least one of aluminum sulfate and ferric chloride; wherein

said primary component may also comprise a polyquaternary ammonium compound; and

b. adding a cationic or anionic polyacrylamide to the thermophilic biological sludge."

The following discussion applies equally to independent claims 16, 17 and 18.

None of the references presented teach the dewatering of "thermophilic biological sludge with a salt of aluminum and/or of iron in combination with a cationic or anionic polyacrylamide." Further, one of ordinary skill in the art would not have known to use a salt of aluminum and/or of iron to dewater thermophilic biological sludge, or any biological sludge for that matter, as it was generally known by those of ordinary skill in the art that salts alone or salts in combination with a cationic polyacrylamide do not perform as well as a cationic polyacrylamide alone.

One of ordinary skill in the art would: be a person with a degree in environmental science, or many years of on the job training plus state certification; have knowledge of the Environmental Protection Agency (EPA) and its rules, regulations and recommendations; and be either employed by a municipality or industry in the environmental services center, or a supplier to one of those organizations.

One of ordinary skill in the art would know of a publication by Chitikela and Dentel, wherein Chitikela/Dentel do not prefer HDTMA or ferric chloride. In the Chitikela/Dentel reference, page 6 states:

> "Figures 1 and 2 show the results of conditioning and dewatering results for both the EBMUD and Philadelphia sludges, when conditioned with Percol 757, ferric chloride, or HDTMA individually. These results once again confirm that cationic polymers are very effective in sludge conditioning when compared to the inorganic chemical conditioning with ferric chloride. Use of a cationic surfactant in sludge conditioning is unconventional, but its optimum dose on a mass basis is not comparable to that of ferric chloride. However, this finding is of little practical use since HDTMA is significantly more expensive than ferric chloride or flocculant polymers per unit mass."

Further, one of ordinary skill in the art would not have known to use a salt of aluminum and/or of iron to dewater thermophilic biological sludge as it was generally known by those of ordinary skill in the art that thermophiles or thermophilic biological sludge was not easily dewaterable. At the time of the conception and reduction to practice of the claimed invention, one of ordinary skill in the art would have knowledge of the Environmental Protection agency (EPA) and its rules, regulations and recommendations. In particular, one of ordinary skill in the art would have knowledge of an EPA publication:

> TBS Prakasam, S Soszynski, DR Zenz, C Lua-Hing, L Blyth, and G Sernel, *Effect of Recycling Thermophilic Sludge on the Activated Sludge Process*, EPA Project Summary 5, September 1990.

Said EPA Project Summary states under the heading:

> "Dewaterability
>
> Capillary suction time (CST) measurements at various polymer dosages indicated that mesophilic sludge required a lower polymer dosage than did the thermophilic sludge (10

vs. 22.5 kg/dry tonne) to achieve the minimum CST that was possible. The thermophilic sludge, however, exhibited a higher floc strength than did the mesophyllic sludge.

Pilot scale centrifuge studies confirmed that the thermophilic sludge required a higher polymer dosage than did the mesophyllic sludge. At optimum polymer dosages, those studies also indicated that the mesophyllic sludge approached 100% solids capture whereas the thermophilic solids approached a maximum of 96% solids capture. The lower solids capture with thermophilic sludge probably resulted from the higher concentration of fine particles in it than in the mesophyllic sludge."

The project summary goes on to recommend that:

> "Based on the lack of effect on sludge mass end the increase in digestion capacity required, the Torpsy process is not recommended for Chicago's conventional rate activated sludge plants. Nor is themophilic digestion as the terminal sludge digestion process recommended if the sludge is to be used at a site with nearby neighbors."

Thus when Gould states

> "The major reasons for commercial acceptance of anaerobic sludge digestion are that this method is capable of stabilizing large volumes of dilute organic slurries, results in low biological solids (biomass) production, produces relatively <u>easily dewaterable sludge</u> and is a producer of methane gas." (emphasis added)

one of ordinary skill in the art would know that Gould et al. was not referring to thermophiles or to thermophilic sludge.

One of ordinary skill in the art would be either employed by a municipality or industry in the environmental services center, or a supplier to one of those organizations. The disposal of sewage is a tax burden to municipalities and a cost burden to industry. Both would prefer to dump the sewage into the closest stream and let the down stream inhabitants worry about the disposal problem. It is only because of state and federal regulations that either is taking corrective action.

The Examiner has invited Applicant "to produce evidence to support the assertion that "Both" [municipalities and industry] would prefer to dump sewage into the

closest stream and let the down stream inhabitants worry about the disposal problem [than take corrective action]." In response, Applicant presents to the Examiner three references: *Clean Water Act History*, published by the US EPA; A Speech by Carol M. Browner, Administrator US EPA dated 10/17/97 entitled "*25'th Anniversary of the Clean Water Act Minneapolis, Minnesota*"; and *Clean Water Clean Water Act*, published by The Sierra Club. During the referenced speech, Administrator Browner states:

> "Before the Clean Water Act, water quality in many, many parts of our country was simply deplorable. Many of America's great waterways – so vital to our health, our commerce and our very identity as a nation – had become places to avoid. The Hudson River contained bacteria levels of 170 times the safe limit. The Cuyahoga River in Ohio actually caught fire. And, the Upper Mississippi – this father of waters, this national treasure – was in serious decline. There was a reason for this. Raw Sewage and industrial waste was routinely dumped into rivers, lakes and coastal waters. There was simply no method in place of effectively controlling the pollution that was fouling America's waters. But 25 years ago, the American people said "enough." The Clean Water Act passed both Houses of Congress by overwhelming, bipartisan margins."

The first paragraph of the referenced Clean Water Act History states:

"Growing public awareness and concern for controlling water pollution led to enactment of the Federal Water Pollution Control Act Amendments of 1972. As amended in 1977, this law became commonly known as the Clean Water Act. The Act established the basic structure for regulating discharges of pollutants into the waters of the United States. It gave the EPA the authority to implement pollution control programs such as setting wastewater standards for industry…It also funded the construction of sewage treatment plants under the construction grants program…"

The first paragraph of Clean Water Clean Water Act states:

"October 18, 2002 marked the 30'th anniversary of the Clean Water Act, one of he most successful environmental laws in our nations history…Thanks to the Clean Water Act, today nearly two-thirds of our lakes and rivers are safe for swimming, compared to just 36% in 1970…"

As indicated in the references, without legislation and enforcement of legislation by the US EPA, waterways and lakes would be polluted with industrial and municipal sewage.

Therefore, financial considerations would be important to a person of ordinary skill in the art. The above quoted EPA report states that:

> "At optimum polymer dosages, those studies also indicated that the mesophyllic sludge approached 100% solids capture whereas the thermophilic solids approached a maximum of 96% solids capture."

The 96% solids capture would require the additional and substantive expense of recirculating the additional solids, sludge, through the treatment facility. Due to this cost factor, a person of ordinary skill, upon reading the Chitikela/Dentel reference and having knowledge of the EPA report, would be led in a direction divergent from the path that was taken by Applicant.

Even as late as 2000, a paper given at WEFTEC by a scientist at Virginia Polytechnic Institute concluded that: "Thermophilic anaerobic digestion results in poor dewatering characteristics."

Additionally, the combination of references would not be obvious to one of ordinary skill in the art to practice and the claimed inventions could not be achieved without undue experimentation. The experimentation expectation is accurately confirmed by Chitikela/Dentel on page 2, which states:

> "The means by which chemical conditioners interact with the colloidal phase in biological suspensions to facilitate the release of water is poorly understood, with the optimal amounts and types of conditioners required depending on a variety of factors. These include both aqueous and surface chemistries of the sludge, and the physical properties of he suspended solids, which are determined by characteristics of the original wastewater and by the operational parameters for the various treatment processes employed in the plant. Also important is the chemistry of any chemical conditioner used, and how it interacts with the bio-solids."

Thus, **<u>the conditioning process is a multivariate problem with no simple strategy available for its optimization</u>**. At present, the required dosages for chemical conditioning must be determined empirically. With this being the case, the use of multiple

chemical additives becomes less feasible because of the difficulty in identifying a proper dose.

Thus, the quantity of experimentation necessary to achieve Applicant's claimed inventions is substantial. At the time of the reduction to practice by Applicant, there would have been no direction or guidance provided by the prior art. There were no successful examples; just the opposite as demonstrated in the EPA document and as taught by Chitikela/Dentel. Applicant's claims relate to treatment of sewage and thus, to experiment would require the availability of a sewage treatment plant and the financial resources necessary to obtain the different chemical compounds and to carry out the experimentation. Prior to Applicant's disclosures, the cause of the difficulty of treating thermophilic sludge was not known and thus, the teachings of the prior art were unpredictable; compare the difference between Gould et al. and the US EPA reference.

Applicant's claims are species claims and would require additional experimentation to be reduced to practice as compared to generic claims. The skill of the practitioner was previously defined as an environmental engineer or scientist and thus would only have a limited knowledge of organic chemistry and microbiology. Consequently, one of ordinary skill in the art would not have enough in depth knowledge to understand the working of Applicant's claimed invention without Applicant's disclosure.

And, Applicant's disclosure teaches why the use of a salt of aluminum and/or of iron in combination with a cationic or an anionic polyacrylamide will outperform a cationic polyacrylamide or a cationic flocculant, alone. Specifically, col. 1 lines 50 – 53 state:

> "Meanwhile, traditional polyacrylamide polymers used for dewatering have been shown to perform very poorly in tests for dewatering of sludge that has been digested by any thermophilic digestion process."

Followed by col. 2 lines 44 – 55 stating:

> "Despite the disadvantages of mesophyllic bacteria, mesophyllic bacteria are preferable in relation to the dewatering of digested sludge. Mesophyllic bacteria naturally secrete a polysaccharide which acts as a tackifier providing a chemical mechanism of floc formation. This chemical mechanism is an aid to traditional cationic polyacrylamides to begin the dewatering process. However,

thermophilic bacteria do not secrete a tackifying polysaccharide. Furthermore, thermophilic bacteria naturally repel each other. This repelling nature of thermophilic bacteria makes the dewatering of sludge from the thermophilic digestion process expensive and difficult."

Followed by col. 4 lines 52 – 65 stating:

"The present invention provides a method for effectively and efficiently dewatering any sludge, with emphasis on dewatering biological sludge from a thermophilic digestion process."

And followed by col. 8 lines 31 – 37 stating:

"Method five involves the addition of polymeric quaternary ammonium compounds, aluminum sulfate, ferric chloride and blends thereof, as primary component to the biological sludge. Polyacrylamide is then added to the biological sludge such that the primary component and the polyacrylamides combine to enhance dewatering of the sludge."

Therefore, and in direct comparison to the cited references, Applicant's teachings go against teachings of the US EPA, the Virginia Polytechnic Institute, Gould, and Chitikela/Dentel; Applicant does this while teaching why Applicant's invention performs in the dewatering of thermophilic bacteria.

Nielsen – As so indicated by the Examiner, "Nielsen does not appear to anticipate claim 1 because Nielsen does not describe the addition of "aluminum sulfate, ferric chloride and blends thereof, as primary component" along with the Percol 406 (poly DADMAC) polymeric quaternary ammonium compound to the digested biological sludge."

Therefore, while Nielsen does not enable or anticipate the use of "aluminum sulfate and/or ferric chloride," Chitikela/Dentel as a reference also would not lend one of ordinary skill in the art would to anticipate the use of ferric chloride with the teaching of Nielsen.

Sorensen – As previously presented by Applicant, Sorensen does not teach the dewatering of thermophilic bacteria or the dewatering of bacteria from a thermophilic

digestion process. Further, as previously presented by the Examiner, "Sorensen teaches that it was known to treat the sewage sludge suspension with an inorganic coagulant, such as aluminum sulfate (page 12 line 16) or ferric chloride (page 12 line 16+), and a polymeric flocculant (page 1 lines 8 -17)." Therefore, Sorensen teaches equivalence between aluminum sulfate and ferric chloride.

However, since Sorensen does not anticipate the difficulties as stated in the US EPA, Virginia Polytechnic Institute and WEFTEC references, one of ordinary skill in the art would further know that Sorensen was not referring to thermophiles or to thermophilic biological sludge. Therefore, the difference between Sorensen and Applicant's claims is that all of Applicant's claims apply to thermophiles or to thermophilic biological sludge or to sludge from a thermophilic digestion process; where by comparison, the skilled practitioner would know that Sorensen was not referring to thermophiles or to thermophilic biological sludge. The Sorensen equivalence when applied to thermophilic sludge (which is not taught by Sorensen) is in direct contradiction with the EPA paper reference, the Virginia Polytechnic Institute reference and the WEFTEC reference. In addition, the Sorensen equivalence is in direct conflict with the Chitikela/Dentel reference; this is while Sorensen does not teach or suggest the dewatering of thermophilic bacteria or teach or suggest the dewatering of sludge from a thermophilic digestion process.

As one of ordinary skill in the art would have the US EPA, Virginia Polytechnic Institute, WEFTEC and Chitikela/Dentel references available, Sorensen would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would know that thermophilic biological sludge has poor sludge dewatering characteristics and would believe that salts of aluminum and/or of iron are not preferred to or in conjunction with cationic polyacrylamides. Therefore, one of ordinary skill in the art would not believe Sorensen to be enabling, without the teaching of the Applicant, as referenced above.

In conclusion, then, by using Sorensen as a reference, one of ordinary skill in the art would not see as obvious, anticipate or have a reasonable anticipation of success the invention of Applicant, as one of reasonable skill in the art would have the US EPA, Virginia Polytechnic Institute, WEFTEC and the Chitikela/Dentel references. The difference between Sorensen and Applicant's claims is that all of Applicant's claims apply

to thermophiles or to thermophilic biological sludge or to sludge from a thermophilic digestion process; wherein by comparison, the skilled practitioner would know that Sorensen was not referring to thermophiles or to thermophilic biological sludge.

Gould - As previously presented by Applicant, Gould does not anticipate the difficulties associated with the dewatering of thermophilic bacteria or of bacteria from a thermophilic digestion process. Gould states, again,

> "The major reasons for commercial acceptance of anaerobic sludge digestion are that this method is capable of stabilizing large volumes of dilute organic slurries, results in low biological solids (biomass) production, produces relatively <u>easily dewaterable sludge</u> and is a producer of methane gas." (emphasis added)

Since Gould does not anticipate the difficulties as states in the US EPA, Virginia Polytechnic Institute and WEFTEC references, one of ordinary skill in the art would know that Gould was not referring to thermophiles or to thermophilic biological sludge. The difference between Gould and Applicant's claims is that all of Applicant's claims apply to thermophiles or to thermophilic biological sludge; where by comparison, the skilled practitioner would know that Gould was not referring to thermophiles or to thermophilic biological sludge.

Further, Gould has no teaching as to the use of a salt of aluminum and/or of iron; therefore, Gould has no teaching in reference to Chitikela/Dentel. It only follows, then, that the combination of Gould and Chitikela/Dentel would teach one of ordinary skill in the art to dewater themophilic bacteria or bacteria from a thermophilic digestion process by only utilizing a cationic polyacrylamide. Such a teaching conflicts with Applicant's invention.

As previously stated, then, Gould is in direct contradiction with the US EPA reference. And, Gould is in direct contradiction with the Virginia Polytechnic Institute reference. Further, the combination of Gould and Chitikela/Dentel conflicts with Applicant's invention.

In conclusion, one of ordinary skill in the art would not see as obvious, anticipate or have a reasonable anticipation of success the invention of the Applicant, as one of reasonable skill in the art would have the US EPA, Virginia Polytechnic Institute and the

Chitikela/Dentel references. In addition, Applicant's claims apply to thermophiles or to thermophilic biological sludge or to sludge from a thermophilic digestion process; where by comparison, the skilled practitioner would know that Gould was not referring to thermophiles or to thermophilic biological sludge.

Pohoreski – As previously presented by Applicant, Pohoreski does not teach or suggest the dewatering of thermophilic bacteria or the dewatering of bacteria from a thermophilic digestion process. In actuality, Pohoreski teaches a process of water clarification and not a process of bio-solids or sludge dewatering, much less teach or suggest the dewatering of thermophilic bacteria or of the dewatering of bacteria from a thermophilic digestion process. In comparison, Pohoreski teaches a method of creating sludge by water or sewage clarification. In the abstract, Pohoreski states:

> "The method includes adding, to the **<u>sewage or other impure water</u>** in a mixing zone, all three individually but no more than two premixed together of the following: (a) an inorganic coagulant, (b) an anionic polymer, and (c) a cationic polymer, with intimate mixing of the added chemicals with the sewage or other impure water, with the proviso that (d) the inorganic coagulant, either alone or with the anionic polymer or the cationic polymer, cannot be added last; and (e) the anionic polymer and the cationic polymer cannot be intimately mixed and added together." (emphasis added)

Therefore, <u>Pohoreski does not anticipate the dewatering of any sludge much less the dewatering of thermophilic sludge.</u> Also, Pohoreski does not anticipate the difficulties as stated in the US EPA, Virginia Polytechnic Institute and WEFTEC references; therefore, one of ordinary skill in the art would know that Pohoreski was not referring to the dewatering of thermophiles or to the dewatering of thermophilic biological sludge. The difference between Pohoreski and Applicant's claims is that all of Applicant's claims apply to the dewatering of thermophiles or to the dewatering of thermophilic biological sludge; and, the skilled practitioner would know that Pohoreski was not referring to dewatering, much less to the dewatering of thermophiles or to the dewatering of thermophilic biological sludge.

In conclusion, as one of ordinary skill in the art would have the US EPA, Virginia Polytechnic Institute, WEFTEC and Chitikela/Dentel references available, Pohoreski

would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would know that thermophilic biological sludge has poor sludge dewatering characteristics and would believe that salts of aluminum and/or of iron are not preferred to or in conjunction with cationic polyacrylamides. Therefore, one of ordinary skill in the art would not believe Pohoreski to be enabling in the dewatering of thermophiles or the dewatering of sludge from a thermophilic digestion process, without the teaching of the Applicant, as referenced above. In addition, Applicant's claims apply to thermophiles or to thermophilic biological sludge or to sludge from a thermophilic digestion process; where by comparison, the skilled practitioner would know that Pohoreski was not referring to thermophiles or to thermophilic biological sludge.

Haldeman – As previously presented by Applicant, Haldeman does not teach the dewatering of thermophilic bacteria or the dewatering of bacteria from a thermophilic digestion process. Further, Haldeman does not teach or suggest the use of a salt of aluminum and/or of iron. Applicant obtained an electronic version of Haldeman from uspto.gov and performed a search for alum, aluminum, iron and salt; these words do not even appear in Haldeman.

Therefore, as one of ordinary skill in the art would have the US EPA, Virginia Polytechnic Institute, WEFTEC and Chitikela/Dentel references available, Haldeman would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would know that thermophilic biological sludge has poor sludge dewatering characteristics and would believe that salts of aluminum and/or of iron are not preferred to or in conjunction with cationic polyacrylamides. One of ordinary skill in the art would not believe Haldeman to be enabling, without the teaching of the Applicant, as referenced above. In addition, Applicant's claims apply to thermophiles or to thermophilic biological sludge or to sludge from a thermophilic digestion process; where by comparison, the skilled practitioner would know that Haldeman was not referring to thermophiles or to thermophilic biological sludge.

Schwab – Schwab does not teach the dewatering of thermophilic bacteria or of the dewatering of bacteria from a thermophilic digestion process. In contrast, Schwab

teaches a method for separation of microcapsules and preparation of printing inks, Specifically, in the abstract Schwab states:

"A method for forming microcapsules which comprises the steps of:

preparing a slurry of microcapsules containing an ionic or polar emulsifier;

adding a de-emulsifier to said slurry under such conditions that said de-emulsifier coulombically interacts with said emulsifier and said slurry separates into an aqueous phase and a microcapsule rich phase; and

separting said microcapsules from said slurry."

Further, Schwab does not teach or suggest the use of a salt of aluminum and/or of iron to perform any type of coagulation or of flocculation. In contrast, Schwab uses a salt of aluminum or of iron as a de-emulsifying agent. Specifically, col. 3 lines 54 – 61 state:

"The de-emulsifying agents used in the present invention are compounds which are capable of forming ionic or hydrogen bonds with the emulsifier. Typical examples are salts such as alkali or alkaline earth metal borates and, more particularly, sodium borate and borax, calcium salts such as calcium chloride, aluminum salts such as aluminum sulfate, aluminum nitrate, ferric salts such as ferric chloride."

Further, <u>even if Schwab had presented a salt of aluminum or of iron as a coagulant or as a flocculant, which Schwab did not</u>, then one of ordinary skill in the art would have known of the Chitikela/Dentel, US EPA, Virginia Polytechnic Institute and WEFTEC references. Knowing these references and knowing that Schwab did not teach or suggest the dewatering of thermophilic bacteria or of sludge from a thermophilic digestion process, one of ordinary skill in the art would believe that the teachings of Schwab do not apply to thermophilic bacteria or to sludge from a thermophilic digestion process.

Therefore, as one of ordinary skill in the art would have the US EPA, Virginia Polytechnic Institute, WEFTEC and Chitikela/Dentel references available, Schwab would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would know that thermophilic biological sludge has poor sludge dewatering characteristics and would believe that salts of aluminum and/or of iron are not preferred to or in conjunction with cationic polyacrylamides. One of ordinary skill in the art would not believe Schwab to be enabling, without the teaching of the Applicant, as

referenced above. In addition, Applicant's claims apply to thermophiles or to thermophilic biological sludge or to sludge from a thermophilic digestion process; where by comparison, the skilled practitioner would know that Schwab was not referring to thermophiles or to thermophilic biological sludge.

Wiker – Wiker does not teach or suggest the dewatering of thermophilic bacteria or of the dewatering of bacteria from a thermophilic digestion process. In contrast Wiker teaches the preparation of Mica and Vermiculite Paper. Specifically, in the abstract Wiker states:

> "Mineral paper is provided which comprises a wet-laid sheet of 1) fibers, 2) a floc of a silicate selected from the group consisting of mica and vermiculite, the said floc having a cationic polymeric flocculant having a molecular weight in the range of from about 10,000 to about 1,000,000. A process is described herein for the preparation of the paper using the two flocculants by first flocculating with the cationic polymeric flocculant and then flocculating in another step with the non-ionic polymeric flocculant to obtain an easily drained flocculated mixture which is dewatered to obtain the mineral paper."

Further, Wiker does not teach or suggest the use of a salt of aluminum and/or of iron. Applicant obtained an electronic version of Wiker from uspto.gov and performed a search for alum, aluminum, iron and salt; these words do not even appear in Wiker.

Therefore, as one of ordinary skill in the art would have the US EPA, Virginia Polytechnic Institute, WEFTEC and Chitikela/Dentel references available, Wiker would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would have known that thermophilic biological sludge has poor sludge dewatering characteristics and would believe that salts of aluminum and/or of iron are not preferred to or in conjunction with cationic polyacrylamides. One of ordinary skill in the art would not believe Wiker to be enabling, without the teaching of the Applicant, as referenced above. In addition, Applicant's claims apply to thermophiles or to thermophilic biological sludge or to sludge from a thermophilic digestion process; where by comparison, the skilled practitioner would know that Wiker was not referring to thermophiles or to thermophilic biological sludge.

35 USC § 103 – Nielson / Sorensen

Claims 1, 2, 4 - 9, 15 - 21 are rejected under 35 USC Sec. 103(a) as being obvious over Nielsen, Sorensen, and Pohoreski, as interpreted in the light of Haldeman and either Schwab or Wiker, for the reasons set forth in the previous Office action mailed 9/25/03.

Applicant's Response

As stated previously, neither: Sorensen, Pohoreski, Haldeman, Schwab nor Wiker teach or suggest the dewatering of thermophilic bacteria or the dewatering of sludge from a thermophilic digestion process. Therefore, and since this combination does not anticipate the difficulties as stated in the US EPA, Virginia Polytechnic Institute and WEFTEC references, one of ordinary skill in the art would know that these references were not referring to thermophiles or thermophilic biological sludge or sludge from a thermophilic digestion process. The difference between this combination of references and Applicant's claims is that all of Applicant's claims apply to thermophiles or to thermophilic biological sludge; where by comparison, the skilled practitioner would know that this combination of references was not referring to thermophiles or to thermophilic biological sludge.

Further, as presented by the Examiner, Nielsen does not anticipate the use of aluminum sulfate and/or of ferric chloride. Further yet, the combination of cited references including Nielsen is in direct conflict with the US EPA, Virginia Polytechnic Institute, WEFTEC and Chitikela/Dentel references.

At the time of conception and reduction to practice one of ordinary skill in the art would have knowledge of the US EPA, Virginia Polytechnic Institute and Chitikela/Dentel references; therefore, the cited combination would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would have known that thermophilic biological sludge has poor sludge dewatering characteristics and that salts of aluminum and/or of iron are not preferred to or in combination with cationic polyacrylamides. Therefore, one of ordinary skill in the art would not believe the cited combination to be enabling, wherein it would not be obvious, nor would there be an

incentive, anticipation or reason to combine the cited references to obtain the invention of the Applicant, without the teaching of the Applicant, as referenced above.

Further, the combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker will not achieve the claimed invention without undue experimentation, as previously discussed.

In conclusion, then, the cited combination of references does not render obvious, teach, suggest or provide anticipation to "dewater thermophilic biological sludge with a salt of aluminum and/of of iron in combination with a cationic or an anionic polyacrylamide." Therefore, claims 1, 2, 4 - 9, 15 - 21 are allowable over the cited combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker.

Sorensen and Gould

Claims 16 and 18 are rejected under 35 USC § 103(a) as obvious over Sorensen and Gould for the reasons of record.

Applicant's Response

Claim 16 of the Applicant states:

"16. A sludge composition, comprising:
water;
solids comprising thermophiles;
aluminum sulfate; and
polyacrylamide."

And, claim 18 of the Applicant states:

"18. A sludge composition, comprising:
water;
solids comprising thermophiles;
aluminum sulfate and ferric chloride; and
polyacrylamide."

As previously presented, neither Sorensen nor Gould present, teach or suggest the dewatering of thermophiles or of sludge from a thermophilic digestion process. Since

neither Sorensen nor Gould anticipate the difficulties as stated in the US EPA, Virginia Polytechnic Institute and WEFTEC references, one of ordinary skill in the art would know that the cited references were not referring to thermophiles or to thermophilic biological sludge or to sludge from a thermophilic digestion process.

Further, Gould does not present any dewatering method, chemical or process.

At the time of conception and reduction to practice one of ordinary skill in the art would have knowledge of the US EPA, Virginia Polytechnic Institute and Chitikela/Dentel references; therefore, the cited combination would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would have known that thermophilic biological sludge has poor sludge dewatering characteristics and that salts of aluminum and/or of iron are not preferred to or in combination with cationic polyacrylamides. Therefore, one of ordinary skill in the art would not believe the cited combination to be enabling, wherein it would not be obvious, nor would there be an incentive, anticipation or reason to combine the cited references to obtain the invention of the Applicant, without the teaching of the Applicant, as referenced above.

Further yet, the combination of Sorensen and Gould will not achieve the claimed invention without undue experimentation, as previously discussed.

In conclusion, the cited combination of references does not render obvious, teach, suggest or provide anticipation to "dewater thermophilic biological sludge with a salt of aluminum and/of of iron in combination with a cationic or an anionic polyacrylamide." Therefore, claims 16 and 18 are allowable over the cited combination of Sorensen and Gould.

Claims 3 and 24

Claim 3 is rejected under 35 USC § 103(a) as obvious over Nielsen, Sorensen, and Pohoreski (interpreted in light of Haldeman and either Schwab or Wiker), as applied above to claims 1 and 17 respectively, further in view of Applicants admission of USP 5965027 to Allen, for the reasons of record.

Applicant's Response

Allen does not teach or suggest the dewatering of thermophilic bacteria or of the dewatering of bacteria from a thermophilic digestion process. Similar to Pohoreski, Allen teaches a process of water clarification and not a process of bio-solids or of sludge dewatering, much less teach or suggest the dewatering of thermophilic bacteria or of the dewatering of bacteria from a thermophilic digestion process. In comparison, Allen teaches a process for removing silica from wastewater. In the abstract, Allen states:

> "A process and system for removing silica from large volumes of wastewater is disclosed. In the process, a wastewater stream containing silica is treated with a chemical coagulant, such as epichlorohydrin/dimethylamine polymer, to create spherical particles which agglomerate into clusters having a diameter greater than 5 microns. Treated wastewater is passed through a microfiltration membrane which physically separates the silica contaminant particle from the wastewater."

Therefore, since at the time of conception and reduction to practice one of ordinary skill in the art would have knowledge of the US EPA, Virginia Polytechnic Institute and Chitikela/Dentel references, the cited combination would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would have known that thermophilic biological sludge has poor sludge dewatering characteristics and that salts of aluminum and/or of iron are not preferred to or in combination with cationic polyacrylamides. One of ordinary skill in the art would not believe the cited combination to be enabling, wherein it would not be obvious, nor would there be an incentive, anticipation or reason to combine the cited references to obtain the invention of the Applicant, without the teaching of the Applicant, as referenced above.

Further, the combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker, further in view of Allen will not achieve the claimed invention without undue experimentation, as previously discussed.

In conclusion, the cited combination of references does not render obvious, teach, suggest or provide anticipation to "dewater thermophilic biological sludge with a salt of aluminum and/or of iron in combination with a polymer of epi-DMA and a cationic or an anionic polyacrylamide." Therefore, claim 3 is allowable over the cited combination of

Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker, further in light of Allen.

Claim 24 has been cancelled.

"Primary Sludge"

Claim 13 is rejected under 35 USC § 103(a) as obvious over Nielsen, Sorensen, and Pohoreski (interpreted in light of Haldeman and either Schwab or Wiker), as applied above to claims 1, 16, 17, and 18, respectively, further in view of one or more of USP 4380496, USP 3613564, and USP 33977139, for the reasons of record.

At page 29, applicant admits that "biological solids are mixed with primary solids because both streams require dewatering and it is much more efficient to utilize the same dewatering equipment to effect dewatering for both streams."

Applicant's Response

USP 4380496 – USP 4,380,496 to Maffet describes a mechanical dewatering process. As claim 13 is dependent upon claim 1, it is important to note that Maffet does not teach or suggest the dewatering of thermophilic bacteria or of the dewatering of sludge from a thermophilic digestion process. In contrast, Maffet describes a mechanical dewatering process utilizing a non-uniform screw conveyor. Specifically, in the abstract Maffet states:

> "A process and an apparatus for mechanically dewatering municipal sewage sludge or peat."

Further, Maffet does not teach or suggest the use of a salt of aluminum and/or of iron. Further yet, Maffet does not teach or suggest any conditioning chemistry. Applicant obtained an electronic version of Maffet from uspto.gov and performed a search for polymer, polyacrylamide, alum, aluminum, iron and salt; these words do not even appear in Maffet.

Therefore, since at the time of conception and reduction to practice one of ordinary skill in the art would have knowledge of the US EPA, Virginia Polytechnic Institute and Chitikela/Dentel references, the cited combination would not make

Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would have known that thermophilic biological sludge has poor sludge dewatering characteristics and that salts of aluminum and/or of iron are not preferred to or in combination with cationic polyacrylamides. One of ordinary skill in the art would not believe the cited combination to be enabling, wherein there would be no incentive, anticipation or reason to combine the cited references to obtain the invention of the Applicant, without the teaching of the Applicant, as referenced above.

Further, the combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker, further in light of Maffet will not achieve the claimed invention without undue experimentation, as previously discussed.

In conclusion, the cited combination of references does not render obvious, teach, suggest or provide anticipation to "dewater thermophilic biological sludge mixed with primary sludge by contact with a salt of aluminum and/of of iron in combination with a cationic or an anionic polyacrylamide." Therefore, claim 13 is allowable over the cited combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker, further in light of Maffet.

USP 3613564 - USP 3,613,564 to Wheeling describes a sludge dewatering apparatus. As claim 13 is dependent upon claim 1, it is important to note that Wheeling does not teach or suggest the dewatering of thermophilic bacteria or of the dewatering of sludge from a thermophilic digestion process. In contrast, Wheeling describes a sludge dewatering apparatus. Specifically, in the abstract Wheeling states:

> "An apparatus for removing aqueous liquid from a flowable material, containing aqueous liquid as a continuous phase and suspended solids as a discontinuous phase, to obtain a dewatered product has two endless, driven belts of elongated porous sheets. The belts are supported so that one belt has its path of travel inside that of the other belt and with an upper horizontal run of the outer belt overlying and abutting that of the inner belt moving in the same direction. The sheet of the inner belt is resilient, compressible and made of cellular material capable of absorbing aqueous liquid by a wicking action, whereas the sheet of the outer belt is a fine-mesh sheet with pores providing passage of the liquid through the sheet by a wicking action of the abutting cellular sheet while retaining most

of the solids on the outer belt. A feeder for delivering the flowable material onto the outer belt is mounted adjacent the beginning of the dewatering zone where there is the wicking action due to the abutment of the two belts along that zone. A device for removing dewatered product is mounted downstream of that zone. A device to compress the inner belt downstream of the upper horizontal run of that belt includes a pair of opposed rolls. Another compression device may be at the upper horizontal run but downstream of the dewatering zone at which initial wicking occurs."

Further, Wheeling does not teach or suggest the use of a salt of aluminum and/or of iron. Therefore, since at the time of conception and reduction to practice one of ordinary skill in the art would have knowledge of the US EPA, Virginia Polytechnic Institute and Chitikela/Dentel references, the cited combination would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would have known that thermophilic biological sludge has poor sludge dewatering characteristics and that salts of aluminum and/or of iron are not preferred to or in combination with cationic polyacrylamides. One of ordinary skill in the art would note believe the cited combination to be enabling, wherein there would be no incentive, anticipation or reason to combine the cited references to obtain the invention of the Applicant, without the teaching of the Applicant, as referenced above.

Further, the combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker, further in light of Wheeling will not achieve the claimed invention without undue experimentation, as previously discussed.

In conclusion, then, the cited combination of references does not teach, suggest or provide anticipation to "dewater thermophilic biological sludge mixed with primary sludge by contact with a salt of aluminum and/of of iron in combination with a cationic or an anionic polyacrylamide." Therefore, claim 13 is allowable over the cited combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker, further in light of Wheeling.

USP 3397139 - USP 3,397,139 to Sak describes a secondary treatment process. As claim 13 is dependent upon claim 1, it is important to note that Sak does not teach or

suggest the dewatering of thermophilic bacteria or the dewatering of bacteria from a thermophilic digestion process. As disclosed in the abstract, Sak "involves an improved secondary treatment process."

Therefore, since at the time of conception and reduction to practice one of ordinary skill in the art would have knowledge of the US EPA, Virginia Polytechnic Institute and Chitikela/Dentel references, the cited combination would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would have known that thermophilic biological sludge has poor sludge dewatering characteristics and that salts of aluminum and/or of iron are not preferred to or in combination with cationic polyacrylamides. One of ordinary skill in the art would not believe the cited combination to be enabling, wherein there would be no incentive, anticipation or reason to combine the cited references to obtain the invention of the Applicant, without the teaching of the Applicant, as referenced above.

Further, the combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker, further in light of Sak will not achieve the claimed invention without undue experimentation, as previously discussed.

In conclusion, then, the cited combination of references does not teach, suggest or provide anticipation to "dewater thermophilic biological sludge mixed with primary sludge by contact with a salt of aluminum and/of of iron in combination with a cationic or an anionic polyacrylamide." Therefore, claim 13 is allowable over the cited combination of Nielsen, Sorensen and Pohoreski in light of Haldeman and Schwab or Haldeman and Wiker, further in light of Sak.

112, 2nd paragraph – "DADMAC family"

Claims 2 – 3 are rejected under 35 USC § 112, second paragraph for failing to particularly point out and distinctly claim the subject matter for which patent protection is sought. In claim 2, it is unclear what a "(DADMAC) variety" is because DADMAC is a unique compound. Similarly, in claim 3, it is unclear what an "(epi-DMA) variety" is because epi-DMA is a unique compound. It is not a genus to which more than one species belongs. See the previous Office action. Applicant has shifted from "family" to "variety" without resolving the ambiguity-of-scope issue.

Applicant's Response

To provide proper clarification to the claims, while keeping all available rights to the Applicant, said claims have been reworded as "family of compounds."

Webster's Ninth College Dictionary defines family as:

"**4**: a group of things related by common characteristics: as **a**: a closely related group of chemicals or compounds."

Further, Webster's Ninth College Dictionary defines compound, second definition, as:

"**1**: composed of or resulting from union of separate elements, ingredients, or parts: as **a**: composed of united similar elements sep. of a kind usu. Independent"

There are many methods of preparing a polyquaternary moiety. These are all well known within the industry. For example, DADMAC is manufactured from allyl chloride and di-methyl amine; a family of compounds is easily prepared by varying either the molecular chain length of the allyl or by varying the alkyl groups on the amine, i.e. allyl could have from 4 to 6 or 7 or 8 carbons and di-methyl amine could be methyl-methyl amine or methyl-ethyl amine or ethyl-ethyl amine or methyl-propyl amine, and so on. All of these combinations will create a polyquaternary amine based upon an "allyl chloride" moiety, a.k.a. a family of compounds. As another example, epi-DMA is manufactured with epichlorohydrin and di-methyl amine; a family of compounds can be prepared by varying the alkyl groups on the amine, i.e. di-methyl amine could be methyl-methyl amine or methyl-ethyl amine or ethyl-ethyl amine or methyl-propyl amine, and so on.

It has been learned via decisions in the US Court System over the past few years, that the doctrine of equivalence is difficult in patent enforcement. Further, within the chemical industry, there are often many compounds which can be manufactured within a family of compounds, each of which can perform nearly equivalent to other members in the family of compounds. The Applicant wishes to be sure as to cover well known and easily manufactured equivalents to DADMAC and epi-DMA.

Applicant believes that the best wording to perform such, given the available definitions, is "family of compounds" as defined in Webster's Ninth College Dictionary.

For ease of review by the Examiner, a copy of each page for "compound" and "family" from Webster's Ninth College Dictionary is attached and listed in an Information Disclosure Statement.

New Matter

Claims 5, 6 and 9 are rejected under 35 USC Sec. 112, first paragraph, for failure of the original specification to describe the claimed invention. The application as filed supported, i.e., described, a polyquat/aluminum sulfate ratio in the range of 1:16 to 1:2. See column 8 line 49. This range is not described in the original disclosure. Please point to the column and line where support for this limitation can be found.

Per claim 6, the recited ratio range of 1:1 to 1:20 is not supported whereas the range of 1:8 to 1:10 is (col 6 line 59).

Per claim 9, the recited ratio range of 50ppm: 1% - 5000 ppm: 1% is not supported whereas the range of 50 ppm: 1% - 300 ppm: 1 % is (col 6 line 59).

Applicant's Response

Applicant respects the Examiner's Rejection.

Claim 5, has been amended to recite "range from about 1:16 to about 1:2, by weight."

Claim 6, has been amended to recite "range from about 1:8 to about 1:10, by weight."

Claim 9, has been amended to recite "between about 50ppm:1 percent and about 350 ppm:1 percent."

Claim 10 – 12 Allowable over art

Objection is made to claims 10 – 12 as being dependent on a rejected base claim, but would be allowable if presented in independent form along with filing a terminal disclaimer.

Applicant's Response

Applicant appreciates the Examiner's position.

In combination with other arguments presented in this Response to Office Action Amendment, Claims 10 – 12 should be in a position for allowance.

Double Patenting

Claims 1 – 4, 9, 15, 16 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1 – 4, 7, 8, 13, 14, 15, respectively, of U.S. Patent No. 5846435 to Haase in view of Sorensen and Pohoreski, for the reasons of record.

Applicant's Response

Applicant respects the Examiner's Rejection.

Applicant presents here the same argument as previously presented in relation to Sorensen and Pohoreski.

At the time of conception and reduction to practice one of ordinary skill in the art would have the US EPA, Virginia Polytechnic Institute and, most importantly, the Chitikela/Dentel references available; therefore, the cited combination would not make Applicant's invention obvious to one of ordinary skill in the art, as one of ordinary skill in the art would have known that thermophilic biological sludge has poor sludge dewatering characteristics and that salts of aluminum and/or of iron are not preferred to or in conjunction with cationic polyacrylamides. Therefore, one of ordinary skill in the art would not believe the cited combination to be enabling, wherein it would not be obvious, nor would there be an incentive, anticipation or reason to combine the cited references to obtain the invention of the Applicant, without the teaching of the Applicant, as referenced above.

Further, the combination of Haase '435, Sorensen and Pohoreski will not achieve the claimed invention without undue experimentation, as previously discussed.

In conclusion, then, the cited combination of references does not render obvious, teach, suggest or provide anticipation to "dewater thermophilic biological sludge with a salt of aluminum and/of of iron in combination with a cationic or an anionic polyacrylamide." Therefore, claims 1 – 4, 9, 15 and 16 are allowable over the cited combination of Haase '435, Sorensen and Pohoreski.

CONCLUSION

Applicant requests that this amendment be entered. This amendment places the claims in a condition for allowance. The proposed amendments to the claims do not raise any new matter issues and no additional searching would be required.

Additionally, Applicant has presented a limited amount of evidence that supports the accuracy of Applicant's admitted prior art. Applicant requests that in view of this fact, the amendment be entered, and after due consideration of the facts presented herein, the claims be allowed and a certificate be issued.

Although the above discussion provides sufficient evidence for the allowance of the claims and the issuance certificate, Applicant is additionally referring to the previously submitted Declarations of Audrey Haase and Richard Haase for additional consideration, if deemed necessary. The Declarations show that Applicant's invention was copied by Allied Colloids (a.k.a. Ciba Specialty Chemicals) and Polydyne. Since disclosure, the invention has been a commercial success as evidenced by the cities using the methods and compositions claimed by Applicant. The EPA references and Applicant's admitted prior art demonstrate the long felt need in the art for removing pathogens from biological sludge. One solution is to use thermophilic bacteria. As shown in the Declaration, the EPA reference and Applicant's admitted prior art, the resulting digested thermophilic biological sludge is difficult to dewater. Applicant found that the addition of a salt of aluminum and/or of iron to the sludge in combination with a cationic or an anionic polyacrylamide solves this problem. Such prestigious organizations as the US EPA and the Virginia Polytechnics Institute have attempted to solve the dewatering problem without success. Dentel, Chitikela and Gould failed to appreciate the difficulty of dewatering thermophilic biological sludge.

Respectfully submitted,

Richard A. Haase, Pro Se' Applicant

Date: July 3, 2004

Richard A. Haase
4402 Ringrose Drive
Missouri City, Texas 77459

Telephone: 281.261.9543
Facsimile: 281.261.6505
richard.haase@clearvalue.com